

PLANT COLLECTION IN NEPAL

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"... And the wildest dreams of Kew are the facts of Kathmandu..."—Kipling.

Nepal, lying in the lap of lofty Himalayas, is a naturalist's paradise. The physical features, climate, and geographical position all seem to have contributed to make this country ideal for a plant collector. Although small in size, Nepal contains a variety of plant and animal life, from lush tropical to alpine types such as are seldom met in any one country. It is here that the Indian, Southeast Asiatic, and Sino-Japanese floristic regions of the world merge with each other, making it an interesting place to study plant distribution on the two sides of the Himalayan Mountains.

In the late eighteenth and early nineteenth century, British botanists were actively engaged in the study of the flora of the Indian subcontinent. The pioneering work of Wallich, Hooker, and Roxburgh resulted in the production of such excellent floral studies as *Tentamen Florae Nepalensis* (Wallich, 1820-24), *Flora of British India* (Hooker, 1875-97), and *Flora Indica* (Roxburgh, 1832). Due to its geographical location and particularly to the isolationist policy of the Rana rulers, Nepal at first remained inaccessible to the British botanists and was a "land of mystery" in the eyes of western observers. However, after the 1814-1816 war with the British, the Nepalese rulers agreed to let some British botanists peep through a window (Kathmandu) into the country. How difficult it was for westerners to visit Nepal is obvious from the following remarks of Hooker (1855), "... Dr. Campbell gained the friendship of Jung Bahadur, the most remarkable proof of which is the acceding to his request, and granting me leave to visit the eastern parts of his dominions; no European that I am aware of, having been allowed, either before or since, to travel anywhere except to and from the plains of India and valley of Kathmandu, in which the capital city and British residency are situated."

The situation changed suddenly in 1950 when the autocratic rule of the Rana family came to an end as a result of popular uprising, and the country was opened to westerners for the first time. This opportunity was seized by mountaineers throughout the world and several expeditions were sent to Nepal to scale the renowned Himalayan peaks. The terrain of the country makes it very difficult for an individual collector or a small party to travel alone, and except for the British Museum parties the botanists visiting Nepal during the last decade have all gone as members of mountaineering parties.

PHYSIOGRAPHY AND PLANT DISTRIBUTION

Until a decade back very little was known about rainfall, temperature, or humidity in parts of the country outside Kathmandu, except that

Hooker (1855) did keep an accurate record of these features during his explorations in eastern Nepal. Some scattered accounts are now available (Karan, 1960; Kawakita, 1956) which throw some light on these matters.

Nepal is usually divided into five climatic regions, each characterized by its own topography, climate, and vegetation: subtropical, tropical, temperate, subalpine, and alpine. However, Hagen (1960) proposed seven natural divisions occurring in the following order: 1, the Terai; 2, the Siwalik hills; 3, the Mahabharat Lekh (Lekh-mountain); 4, the Nepal midlands; 5, the Himalayas; 6, the inner Himalayas; 7, the Tibetan marginal mountains. The five climatic regions are grouped into the following three categories: 1, subtropical and tropical; 2, temperate; and 3, subalpine and alpine (fig. 1).

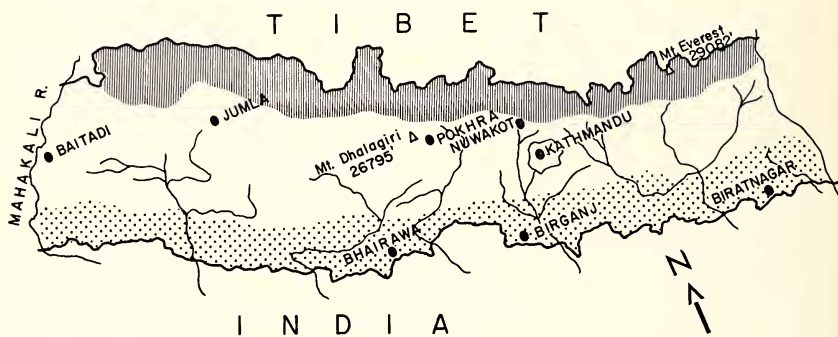


FIG 1. Climatic zones of Nepal: subtropical and tropical (stippled), temperate, and subalpine (hatched).

SUBTROPICAL AND TROPICAL REGION. These regions consist of warm and humid lands and siwaliks (hills) known as Terai, Bhabbar, and Churiya respectively. The altitude varies from less than 500–5000 ft. Terai is part of the alluvial (cis-gangetic) plain of northern India and has a rainfall of 40–80 in (Karan, 1960). The rain occurs mostly during the summer months and the vegetation is more luxuriant in the eastern part of the country than in the western. Terai covers an area of 8000 sq mi and is 10–20 mi in width. *Shorea robusta* (sal or sakhu) is the most dominant species. Other timber species found in Terai and adjoining parts of Nepal are: *Terminalia tomentosa*, *T. belerica*, *Anogeissus latifolia*, *Dalbergia sisso*, *D. latifolia*, *Adina cordifolia*, *Bombax malabaricum*, *Acacia catechu*, and *Cedrela toona*.

Bhabbar is a narrow strip of land between siwalik and Terai extending over 3500 sq mi. The soil contains mainly gravel, boulders, and sand brought down by the streams from the siwalik and Mahabbarat ranges. New forests in this area contain *Acacia catechu* (khiar), *Dalbergia sisso* (sisso), and grasses, many being species of *Saccharum*. In old forests khiar and sisso are replaced by *Bombax malabarica* (semal), *Albizia*

lebbek (siris), *Hymenodictyon excelsum* (lati karma), and *Anogeissus cordi* (karma).

The siwaliks known in Nepal as Churiya pahad (hills) extend from Afghanistan to Assam. The soil is gravelly, very porous, and contains little organic matter. A number of duns (valleys) lie between the siwaliks and the Mahabharat ranges. Forests are common in the valley floors and are composed largely of *Acacia catechu*, *Lagerstroemia parviflora*, *Careya arborea*, *Adina cordifolia*, and *Michelia champaca* (champ). The latter is found only in the eastern part of the country.

TEMPERATE REGION. This area consists principally of the Mahabharat ranges and has a cool, humid climate. The elevation varies from 5000–10000 ft. Rainfall and temperature vary from east to west, and are generally higher in the east than in the west. The "heart of the country," as Hagen (1960, p. 69) calls these Nepal midlands, lies between Mahabharat and the high Himalayas. Hagen divides it into nine natural regions, each including a wide valley drained by one of the major branches of the great rivers which form the main drainage system of Nepal. They run mainly from north to south in the following west to east sequence: Mahakali, Seti, Karnali, Bheri, Kali Gandaki, Buri Gandaki, Trisuli, Soonkosi, Arun, and Tamur. The vegetation consists of pure or mixed forests of pine and oak. At lower altitudes, *Pinus wallichiana* (Himalayan blue pine), *P. roxburghii*, *Quercus lemellosa*, *Q. dilatata*, *Q. incana*, *Acer campbellii*, *Castanopsis indicus*, and *Pyrus pashia* are the more important tree species. At middle altitudes, 6000–10000 ft, *Quercus semecarpifolia*, *Q. incana*, *Juglans regia*, *Alnus nepalensis*, *Salix tetrasperma*, *Magnolia campbellii*, *Cedrus deodora*, *Picea morinda*, *P. smithiana*, *Abies webbiana*, *Pinus excelsa*, *P. chylla*, *Rhododendron arboreum*, *R. barbatum*, *Betula utilis*, *Thalictrum rotundifolium*, *Berberis aristata*, *B. nepalensis*, *Gaultheria fragrantissima*, *Pieris ovalifolia*, *Clematis buchananiana*, *Spiraea vacciniifolia*, *Rubus paniculatus*, *Hypericum patulum*, and *Cratogeomys crenulata* are found. Epiphytic orchids, ferns, and angiosperms (*Peperomia reflexa* and *Hoya longifolia*) abound in these forests. Species of the tropical and subtropical region interdigitate with those of the temperate region at 6000–7000 ft elevation. The upper limit of the temperate forest is 12000 ft.

SUBALPINE AND ALPINE REGIONS. These regions are composed mainly of the outer and inner Himalayan ranges. The tree line in the central Himalaya lies between 12000 and 13000 ft, extending to 15000 ft in the east. Snowline in the eastern Himalaya is at about 17000 ft (Swan, 1961). Rhododendrons have been reported from the subalpine and alpine regions of Nepal: *R. cowanianum* (10500 ft), *R. campanulatum* (11000–13000 ft), *R. lepidatum*, and *R. anthopogon* (12000–14000 ft). Other woody species at elevations of 10000–14000 ft are: *Quercus semecarpifolia*, *Juniperus squamata*, *Tsuga dumosa*, *Larix griffithii*, *Abies webbiana*, *Cotoneaster* sp., and *Ephedra gerardiniana*, the latter being the dominant species between 12500 and 16000 ft. Herbaceous plants found at these

heights are various species of *Pedicularis*, *Aconitum*, *Thalictrum*, *Potentilla*, *Gentiana*, *Meconopsis*, *Primula*, *Saussurea*, *Lonicera*, *Arenaria*, and *Saxifraga*. The upper limit of vegetation in the Himalaya has been reported to be 20000 ft. Some of the species occurring between 15000 and 20000 ft are: *Rhododendron setosum*, *Juniperus squamata*, *Ephedra gerardiana*, *Gentiana vesusta*, *Primula sikkimensis*, *Meconopsis horridula*, and several lichens. In western Nepal (Jumla-Humla) near Mohala Bhanjyang (Bhanjyang pass, 19500 ft), *Lagotis glauca*, *Potentilla saundersiana* var. *caespitosa*, *Pedicularis* sp., and *Arenaria* sp. have been found (Polunin, 1960). Recently Swan (1961) has reported *Stellaria decumbens* at 20130 ft, a new record in the Nepal Himalaya. *Saussurea gossypiphora* D. Don, which forms clubs of soft white wool from six inches to a foot high (first described as *S. gossypina* by Wallich in 1831), was brought back to Kathmandu by pilgrims from Gosainthan. It has been reported up to an altitude of 17000 feet (Hooker, 1855).

PLANT COLLECTORS IN NEPAL

The history of plant collection in Nepal can be divided roughly into two phases, from 1802 to 1950, and from 1950 to the present. During the first period, Nepal was a "forbidden land" to foreigners, and hence plant explorations were carried out in very small regions of the country. Sir Brian Hodgson, British Resident in Kathmandu from 1822 to 1843, was the first person to bring to the notice of western scientists the incredible variety of plants and animals of Nepal. He published 127 papers which deal with birds, mammals, and reptiles of Nepal. As he was obliged to stay in Kathmandu by an order of the Nepalese Court, he employed Shikaris or professional hunters to collect for him. His primary interests were ornithology and herpetology, and he did little plant collecting himself. However, he encouraged his fellow countrymen to look into the plant life of Nepal. Buchanan Hamilton, later Sir Francis Hamilton, onetime Superintendent of the Honourable East India Company's Botanic Gardens at Calcutta, was perhaps the first botanist to visit Nepal. He stayed in Kathmandu for about a year (1802-1803) and collected plants en route to the valley from the border town of Raxaul (India) and in the valley itself. Nathaniel Wallich, who succeeded Hamilton as Superintendent of the Gardens at Calcutta, was granted permission by the Nepalese Government to visit Kathmandu in 1820. He stayed in the capital city from December 20, 1820 to November 7, 1821, and "visited only one place outside Nepal Valley, viz. Nuwakot, but persuaded pilgrims to bring back curiosities to him when they went to Gosainthan" (Burkill, 1904). The collections of Hamilton and Wallich were catalogued by David Don (1825).

After prolonged negotiations, J. D. Hooker got permission to undertake a botanical expedition in eastern Nepal in 1848. He followed the Tamir (Tamur) and Arun valleys for a considerable distance and reached as far north as Walunchung. He wanted to cross into Tibet, but the por-

ters refused to go any farther north. He, therefore, crossed into Sikkim which he is credited with having "discovered" for the British. Hooker's *Himalayan Journals* (1855) are truly classics in the botanical literature of the world. He reported on the general features, topography, vegetation, and climate of a region unknown to the western world at that time. His description of the local inhabitants is candid and humorous.

Dr. J. Scully in 1876 and J. F. Duthie in 1880 to 1884 are reported (Kitamura, 1955) to have collected plants in parts of western Nepal that adjoin Kumaon division of India.

In 1904, 83 years after Wallich, Burkill (1904), another British botanist, visited Kathmandu, Nuwakot, and other points in the valley where Wallich had collected. It is obvious from reading accounts by Burkill and other visitors of that period that the foreigners were forbidden to wander around by themselves, and the Nepalese Government rarely gave them permission to visit parts of the country other than Kathmandu.

From 1904 to 1927, no significant activities in plant exploration were carried out in Nepal. However, between 1927 and 1937, Captain Lall Dhwoj, a Nepali, and Prof. K. N. Sharma, an Indian, collected extensively for the British Museum in central and western Nepal. The Nepalese Government at this time also took interest in the native plants, especially those with medicinal importance. A botanical farm was established in Shivpuri at 8943 ft altitude about six miles northeast of Kathmandu, to produce on a commercial scale plants such as *Aconitum*, *Digitalis*, and *Lobelia*. Sharma, who headed the Botanical Department of the Government of Nepal, claims to have collected plants from such inaccessible areas as Rasuwa Garhi and Humla. As a result of the efforts of Dhwoj and Sharma, many new species, among them *Meconopsis regia* and *M. dhwojii*, were discovered. Some of these now have a permanent place in the private gardens of the world. Landon's book contains a list of plants from Nepal which was compiled with the help of the Director of the Royal Botanical Gardens at Kew (Landon, 1928).

Oleg Polunin (1950, 1952) was a member of Tilman's expedition to Nepal Himalaya. He surveyed the flora of Langtang Himal and Rasuwa Garhi region (1952), and found *Gentiana nubigena*, *Saussurea gossipiphora*, primulas and rhododendrons at an elevation of 16000 ft.

As already mentioned, the revolution of 1950-1951 brought about a significant change in the outlook of the Government and people of Nepal toward foreigners. In the post-revolution period, westerners were given greater freedom to explore the country, and the many mountaineering expeditions that have come to Nepal in the last decade gave opportunities to a number of botanists to explore plant life in the Himalayas. Col. D. Lowndes (1954), a member of Tilman's second expedition to Nepal in 1950, collected seeds and plants in the vicinity of the Marsyandi River, Managbhot, and the Jargeng Khola. All of these areas are in central Nepal, justly famous for such mountains as Annapurna, Machapucche and Dhaulagiri. Some of the high altitude plants collected by

Col. Lowndes were: *Pedicularis* (12000 ft), *Primula* (10000–14000 ft), *Lonicera* (11500–13000 ft), *Ephedra* (10000–14000 ft) and *Delphinium* (16000 ft). Zimmerman (Vautier, 1959), who accompanied the Swiss expeditions to the peaks at Everest (29082 ft) and Cho Oyu (26750 ft) in 1952 and 1954 respectively, collected plants en route to Namche Bazar from Kathmandu, and also in some of the eastern districts of Nepal.

In the spring of 1952 the British Museum in conjunction with the Royal Horticultural Society sent a team of three botanists, L. H. J. Williams, Oleg Polunin, and W. R. Sykes, to collect in western Nepal. They explored an area of about 1000 sq mi in the districts of Jumla, Humla, Jajarkote, and Salyan, and collected a total of 5000 herbarium specimens, 250 live plants, and 150 seed specimens in their eight-month expedition, collecting mostly in areas lying between 7500 and 20000 ft altitude (Williams, 1952; 1953). Williams led another expedition to West Nepal in 1954, the party consisting of W. R. Sykes and J. D. A. Stainton, both botanists, K. Hyatt, a zoologist, and J. Auinlan, an entomologist. Dr. V. Puri of Meerut College, India, was also with this expedition for about two months. They collected plants south of Dhaulagiri (26795 ft), in the Annapurna Range (20000–26041 ft), and in the Kaligandaki Valley. A number of new plants were described from the collections made in 1952 and 1954 by these British Museum parties (Sykes, 1956).

The Fauna and Flora Research Society of Japan sent two scientific and mountaineering expeditions to Central Nepal in 1952 and 1953. Sasuke Nakao, a botanist, accompanied the Japanese expedition to Manaslu both years, collecting plants in the vicinity of Ganesh Himal, Siringi Himal, Manaslu, and also en route from Kathmandu to Pokhara. The latter town has served as a base camp for many climbing parties in Central Nepal. Members of these two Japanese expeditions collected a total of 958 species of phanerogams and 210 species of cryptogams, of which 300 were new to Nepal (Hirano, 1955; Horikawa, 1955; Kawakita, 1956). Because the Japanese explorers surveyed only a limited area in Central Nepal, some of the identification and remarks on distribution may not be very accurate.

In recent years some Indian botanists have visited Nepal. S. K. Mukerji, Keeper of the Indian Botanic Garden at Calcutta, collected along the Nepal-Sikkim border in 1949. Banerji (1952; 1952a; 1953; 1958) made six trips to Nepal between 1948 and 1956, but he confined his collections to along the main road connecting the capital with all the district headquarters lying east of Kathmandu. He listed 169 species of flowering plants belonging to 123 genera and 51 species, of which 16 are new records for the country. D. D. Awasthi (1960) reported upon the lichen flora of Nepal. His collections are mainly from Biratnagar and Kosi Valley.

J. E. M. Arnold (Davidson, 1955), a member of the Oxford University Expedition to West Nepal, collected plants for the British Museum in

that region. Swan (1961) made two trips to the Nepal Himalaya, first with the American Himalayan Expedition to Makalu (27790 ft) in 1954, and again in 1960 with Sir Edmund Hillary's Yeti hunting expedition. He collected plants and animals in the neighborhood "of Barun Glacier and certain other unnamed peaks in that region," and found evidence of life at the extreme altitudes of 19000 to 22000 ft.

FLORISTIC REGIONS OF NEPAL

Hooker (1904) divided the Himalaya into eastern and western phytogeographic regions. He considered the eastern region to extend from Kumaon to Mishmi hills in upper Assam, and the western region to extend from Chitral to Kumaon division. However, subsequent studies have shown that "Nepal is a meeting place of the eastern and western Himalayan flora" (Stearn, 1960). The flora of humid mountain areas shows a close correspondence with that of western China, Formosa, and Japan (Kitamura, 1955), while the plants in the high mountain arid zone are the same as those found in Tibet. There seems to have been a migration of plants across the Himalayan mountains through gaps in the eastern and northwestern end of the chain. The southeastern elements of the Nepalese flora are known to extend as far west as Kali Gandki, while boreal species (*Poa annua* and *Capsella* sp.) have been collected in Walungchung. Thus the dividing line between the eastern and northwestern floristic elements cannot run along Baghmati River, as Banerji (1952a) seemed to think, because the flora on the two sides of Kali Gandaki is known to be different (Williams, 1953). It is therefore reasonable to assume that the western limit of the southeastern flora could as well be this river.

The collections from Nepal are stored in the herbaria of the British Museum, Royal Botanic Gardens at Kew, Indian Botanic Garden, Linnean Society of London, Missouri Botanic Garden, and Harvard University. Collections are also known to occur in the museums at Paris and Geneva. The author wishes to express his sincere thanks to Lincoln Constance of the University of California, Berkeley, for his help in securing a fellowship that made this survey possible during the author's stay at the above University.

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